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ABSTRACT

Technology, the systematic application of organized knowledge to practical tasks, has much to offer education, but a great deal must be done to realize this potential. Over $1.2 billion has been invested in technology by the United States Office of Education in the last decade alone, but educational technology is still in its adolescence; for example, audiovisual materials are still regarded as peripheral, hardware development outstrips that of software, and the learning industry is still oriented to products rather than clients and learning processes. Technology can make education more productive, immediate, individualized and scientific, but several obstacles must be overcome. These include the inertia and resistance of educators, legal and contractual barriers, public skepticism toward technology's benefits, the lack of software, high costs, and the tendency to identify technological concerns as the responsibility of lower-echelon personnel. To meet these challenges, educators must reexamine their basic goals and institutional structures, disseminate the benefits of technological procedures, and commit themselves to technological change. In the course of so doing they should focus upon specific instructional problems, regard technology as central and integral tools, and search for new and vital ways of solving problems. (PB)

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"THE FUTURE OF EDUCATIONAL TECHNOLOGY"

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Approaching a future-view of educational technology is only slightly more difficult than arriving at a universally acceptable definition. Like the proverbial blind men attempting to describe an elephant based upon the particular part of the anatomy they are touching, one can view educational technology from many different perspectives. It comes as no surprise, then, to find the offerings of this convocation so diverse and eclectic. As a matter of fact, it is probably this quality which persuades so many of us that educational technology holds out a glimmer of hope in what may appear to be an otherwise dark future for american education.

The view point most readily accepted by the educational technology community clearly identifies with the total process of learning rather than with the physical products and materials generally referred to as the "hard-ware" and "software" with which our audiovisual predecessors were identified.

Educational technology as a process means that there is a progression of techniques which can be applied to the learning process, starting with ways to define goals and objectives and ending with ways to evaluate the success of the means chosen to help people reach those ends. As such, we view it as a total systemic approach and not a band-aid effort. John Kenneth Galbraith, who is more noted for his work in economics, has a definition of technology which I think goes to the heart of it. He says technology means "the systematic application of scientific or other organized knowledge to practical tasks." Its most important consequence he says "is in forcing the division and sub-division of any such task into its component parts." Charles Hoban, amplifies this view, saying "technology is not just machines and men. It is a complex, integrated organization of men and machines, of ideas, procedures and management."

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Garry Walz, writing in the November, 1970, Personnel and Guidance Journal, suggests that "to perceive of technology narrowly, in the sense of a machine, is to focus on an outcome of technology rather than on the ideas fundamental to different technologies which constitute their potential for effecting change. The present physical manifestations of technology-computers, teaching machines, audiovisual devices, etc.--are embryonic and will rapidly be displaced by new generations of hardware. Any discussion of technology which focuses on the hardware alone is thus likely to deal with what has been rather than what will be and overlook the fundamental powers of technology!"

In short, the statement of the Commission on Instructional Technology that "technology can make education more productive, more individual and powerful, make learning more immediate, give instruction a more scientific base and make access to education more equal," should serve as a beacon, lighting the way for all of us who strive to carry the message to our school administrators. Perhaps it should even replace whatever we now say as a nightly bedtime prayer.

What the Commission did not say, but our critics frequently do, is that the burden of proof is on those who say that technological means are "better". What that means is that although technological means can service educational ends very well, and often much better than variations on person-to-person learning, there is nothing magic in applying technological means except that it requires a series of decisions that are difficult to make. So it is significant that the most highly-touted success in educational technology in the past few years, Sesame Street, is carried via a familiar medium to a population having the least cultural resistance to innovation in an environment where administrative and professional concerns are

least intrusive. Sesame Street is a long way from the ideal, however, because it never really had to be formally adopted; it simply had to be watched. It may be the best we will ever be able to do. We may either have to resign ourselves to producing combinations of the familiar and the unthreatening, or else we shall have to change people's vision of what is available, useful, serviceable, and familiar.

There is no one single strategy to be applied. A process is a group of techniques that must be varied with circumstances. To that extent, it is always a matter of some trial and error. Some technological applications have already paved the way and their growing impact on educational management should help dispel some professional resistances. Their possible impact on teacher and administrator training, yet to be applied to any appreciable extent, could be a giant step in helping people adopt technological means to educational ends. Since we have the machines, and have demonstrated programming successes, the final step is to put them into a designed process that also includes planning, behavioral models, and evaluation schemes.

But it must not end there. People who decide on educational means will not adopt technological means just because they are challenging or fascinating, but because technology can expand, intensify, and improve learning and learner accessibility, and do it at an acceptable cost. Again, the burden of proof is on those who market the technological means.

The greatest challenge will be to apply educational technology on a mass scale. It will not be enough to design a satisfactory instructional process for one learner, and then try to achieve mass scale simply by multiplying that one design by the number of people who can be reached. Achieving such a mass scale will require a step by step approach: we will not leap from the individual learner to mass scale overnight. The progress to such a scale will require

planning and implementation, first in small-scale situations, and finally of a size and scientific sophistication heretofore unguessed and untried. And we must show all along that educational technology can attain economy of scale while satisfying both the behavioral and specifically instructional goals of all those involved in the process.

The record to date shows that we are still far from achieving the inherent potential which proper applications of educational technology offer. The easiest way to measure whatever progress has been made is to note the degree to which any single or combined technological means has been adopted, particularly in instruction. Any large scale conversion to educational technology will be evolutionary, not revolutionary and the evolution of educational technology like that of all innovations has been typically uneven.

Some of the most important elements of its evolution have been:

..the continuing restriciton of audio-visual materials to a supplementary role

..the inability of educators to translate the Hagerstown success with instructional television as a medium of basal instruction into wide-scale use

..Suppes' and others' learning-effective uses of computer-assisted instruction and the prospect of their cost-effectiveness, now reaching its' adolescence

..The abundance of hardware, the dearth of software and educators' limited knowledge of, or instincts for, technical applications

..the limited success of single application devices such as the "talking typewriter"

..the "learning industry's" preoccupations with the product rather than with the buyer

..the discovery, as with the teaching machine, that the benefits of a complex technical means could be well duplicated by simple, inexpensive devices

..the introduction of the language laboratory and its unused potential for expanded use as a "learning" laboratory

..the use of open and closed-circuit video to provide formal and informal education

..the direct and indirect effects of Sesame Street in dramatizing technology and suggesting the values of a changed perspective.

These evolutionary developments are among the easiest to identify because they are mostly visible, tangible phenomena. But tangled with them is the whole process of adoption: after all, educational technology is a process to be used to get somewhere. Adopting the process, a complex event, must be understood to involve these kinds of factors:

..Professional inertia and/or resistance

..collective bargaining and contracts as legal locks against changed functions.

..the imbalance created by the lack, in quantity and quality, of validated software

..the public and private demand that already-proven means be reproven again and again

..the frequent identification of educational technology as the traditional responsibility of lower-echelon educators

..doubts about student acceptance

..the need to involve interinstitutional, interstate and intrastate agencies and organizations in planning and implementation

..the magnitude of software and hardware costs, particularly the initial outlays.

..the discovery that disadvantaged populations accept and respond more readily to media than to print-based instruction.

In other words, educational technology has a lot to offer and a long way to go. But as Mackenzie warns in the Journal of Educational Technology, "If instructional technology seeks to make its entrance into the system (or an institution) from the periphery, and bases its claim for admission primarily on the repertoire of hardware at its disposal, it not only encounters serious obstacles; it is also bound to be judged in terms of the high costs and apparently limited benefits that follow because those same obstacles confine it to a marginal role."

The application of any new technological tool in education is bound to upset the ecology of education, that delicate balance of elements that includes the learner, the environment, the medium and the message. The need to reexamine this ecological balance may be the greatest contribution technology can make. It forces

the user to clearly define the values and goals to be achieved. And this process of specifying goals and objectives forces the teacher to recognize that there are greater conflicts than were evident before. It also highlights different ways of achieving these goals by opening up the discussion of alternative means. It then becomes possible to begin the process of tailoring individualized instruction to meet specific individual learning needs, according to individual cognitive styles.

Furthermore, we need human involvement if technology is to be effective in solving some of our educational problems. Machines by their nature and programs by their design are methodical, consistent, objective, unemotional and they don't tire easily. They don't forget, misinterpret, react to nonverbal cues, become rattled or stray off the subject. But these very strengths can make these machines and programs cold, calculating, impersonal, hard-driving and controlling. They can, that is, if we let them. There is no machine available today, and none is likely during our life-time, that is not dependent upon human beings for its direction. Even when the programs and machines occasionally go hay-wire and do things that their human developers and programmers had not planned, it is almost always traceable to human error.

A number of people have voiced criticism of the federal government, saying that we have failed to provide the necessary financial support for educational technology. Let me dispel that idea right now by providing a few statistics.

...Title III of the National Defense Education Act provides matching funds for the purchase of hardware for the public schools. Between 1958 and 1971, the Federal contribution was $836.3 Million. NDEA'S Title VII, targeted to research and media dissemination contributed $40.3 Million before it expired in 1968.

...The Educational Broadcasting Facilities Act, for the purchase of

television and radio equipment for use in public, noncommercial, primarily educational stations has spent $80.9 Million since 1962.

...Title VI of the Higher Education Act provides funds for the purchase of instructional equipment for colleges and universities. From 1965 through 1971, $65.2 Million was awarded.

...From 1965 to 1971, $162 million was spent for computers in education from such sources as ESEA Title III, Cooperative Research Act, and NDEA Titles VI and VII.

...Media research, development and training for the handicapped, from 1959 through 1971 accounted for $85.5 million.

...Instructional television from 1965 to 1969 received $35.1 million for non-equipment purchases from a number of different legislative authorities.

Sesame Street and The Electric Company, alone, have received $21 million since 1969.

...Under the provisions of Section 711 of the Emergency School Aid Act $11.3 million was awarded in 1973 for the creation of television programs. A like amount is anticipated for 1974.

...Experimentation with programming and technical support systems for the educational satellite to be launched next spring amount to nearly $10 million.

My mental arithmetic isn't all that good. The point is, though, that

during the past decade, the U.S. Office of Education has invested nearly $1.2 billion dollars in projects in which educational technology played an important role.

But where are the results? Where is the validation of materials? Where is the evaluation, the impact assessment? Why is there such a lack of adoption? How can we measure the true costs (or savings) involved in technology applications?

I believe that the answers to these questions may be found in the same place where Fibber McGee found his many surprises--in the closet! Each of you knows of a closet or a cupboard, or even a warehouse which contains the necessary hardware to mount that project you've been thinking of. Now is the time to open it and assess how these resources can be put to more productive use.

To realize the promise I alluded to earlier will take much more than finding the appropriate hardware or developing and validating the educational software.

Ingrained behavioral patterns which tend to make human beings resistant to change must be overcome. The application of technology will entail a significant alteration of the traditional teaching-learning environment. For technology to succeed in achieving its promise, a majority of American educators must become convinced that the new way is the better way --- and this conversion of human thought patterns may well prove to be the most difficult task facing our embryonic educational technology profession.

Fellow members of the educational technology world, arise and unite. The future is now! - or never. The crises of education will no longer permit us to luxuriate in the rhetoric of promises and hopes. Perhaps it is time to recognize the importance in Edgar Dale's message that much of the effort in educational technology has been concentrated on doing better what perhaps should not be done at all.

Let us similarly heed the thoughts of Richard Hooper: "It is an abiding irony of the newer media that despite their ability to revolutionize and upgrade the quality of education they can by the same token prolong and mirror what is already going on in school. Programmed instruction may actually increase the amount of drill and practice in the classroom. Closed-circuit television might be the worst thing to happen to colleges at a time of bursting student enrollments. Instead of the crisis forcing faculty and administration into retooling the whole system, television has made it possible to solve the problem of large classes in an age-old way. The lecture as the medium of college communication could now be set fair, thanks to television, for another hundred years.

Let us purge the panacea peddlers from our midst. It is time to put them on notice that we will not accept unsubstantiated claims of superiority; that cosmetic changes will not be an acceptable substitute for technical progress.

We can no longer afford to be victimized by the 'not-invented here' syndrome which forces every institution to re-invent every course offering. And we cannot accept the lame excuses by teachers or professors that using media is too complicated and bothersome. It is time that educational technology, wisely and carefully conceived, is woven into the warp and woof of the institutional fabric. If we cannot, or will not, or do not, have the temerity to insinuate the best of what we know and can do into the essence of education, we should follow Harry Truman's dictum and "get out of the kitchen".

And each of your successess --- no matter how small, should be documented in such a way that it serves to add to the body of knowledge regarding educational technology accomplishments. In this way we can demonstrate to our supporters, and our detractors, that technology is part of the solution --- not the problem.

Let me close by suggesting a six-step approach to the application of technology to your educational problems.

First, start with a problem, not with a piece of technology. Then find the appropriate media system to attack it. Second, don't shot-gun your efforts. Select carefully those few important objectives which you can achieve. Then make the media work hard toward that goal. Third, use the new media as a full partner with a serious role to play in the educational process and not simply as some extra measure to enrich the present process. Fourth, integrate media as components in a coherent hybrid system designed to achieve specific and important educational objectives. Do not expect the media to succeed in a stand-alone design or for trivial purposes. Fifth, use the new media in a context of change to help you do new and vital things that simply cannot be done by conventional means. This is where the potential for economy exists, not in the present budget. And finally, do not expect the media to serve as a miracle drug for your ailing educational system. Use the new media for what they are--favorable and potential tools for teachers, administrators and learners. Learn to use these tools appropriately, imaginatively, effectively and efficiently, and they will help education do more, do it better, and do it for more people.

Thank you.

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